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EXPERT REPORT

Nevada State Engineer Water Rights Hearing
Spring Valley, Nevada

Soils

Table of Contents

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Spring Valley, Nevada

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1.0 Opinion

It is our opinion that, according to existing data there are potentially 41,402 acres of playas and/or areas that are ponded during at least part of the year in Spring Valley; and that these areas are potentially prone to wind erosion and generation of dust; and that insufficient data currently exist to adequately characterize the risks of dewatering them, nor to prescribe appropriate mitigation measures in the event the project is implemented as proposed.

2.0 Introduction

This document presents an overview of the existing information regarding the soil-related resources of Spring Valley, Nevada and the potential impacts of a proposed groundwater development project by the Southern Nevada Water Authority (SNWA). The data used in this report were gathered from several sources including the Environmental Impact Statement prepared by the Bureau of Land Management (BLM) in June 2011; the Natural Resources Conservation Service (NRCS) Soil Survey of White Pine Nevada, Eastern Part; and various Baseline Characterization Reports prepared by the SNWA in cooperation with the BLM in January 2008.

The project would convey up to 155,000 acre-feet per year (afy) of water, with up to 122,000 afy of groundwater developed by SNWA and the remaining capacity provided for Lincoln County. The SNWA portion includes pending water rights applications in Spring, Cave, Delamar, Dry Lake and Snake valleys. The proposed facilities associated with this Project are described below:

- Pipelines: approximately 306 miles of buried water pipelines, between 16 and 84 inches in diameter
- Pumping Stations: five pumping station facilities
- Regulating Tanks: six regulating tanks, anticipated to have a capacity of between 3 and 10 million gallons each
- Pressure Reducing Stations: three facilities

- Water Treatment Facility/Buried Storage Reservoir: one facility site with the Water Treatment Facility anticipated to be a 150 million-gallon per day facility and the buried storage reservoir a 40-million gallon buried facility
- Power Lines: approximately 323 miles of 230 kilovolt (kV), 69 kV, and 25 kV overhead power lines
- Electrical Substations: two primary electrical substations (230 kV to 69 kV) and five second

It is not within the scope of this report to predict the environmental results of the proposed action on soils and soil-related factors; rather it is the purpose of this report to discuss those factors that affect the soil environment in the context of the proposed action through consideration of the existing available data; and in this process, perhaps identify areas needing further study and review before implementation.

3.0 Overview of Existing Pre-Development Resources

A large number of studies have been conducted regarding this proposed action. Those that were utilized in this assessment were (1) BLM Baseline Characterization Reports including Geology, Hydrology, Groundwater Resources, and Water Quality; (2) BLM Environmental Impact Statement of June 2011; and (3) Natural Resources Conservation Service Soil Survey of White Pine County, Eastern Part.

Spring Valley is about 120 miles long and 16 miles wide. Spring Valley is bounded by the Schell Creek Range to the west, the Antelope Range to the north, the Snake Range and the Limestone Hills to the east, the Wilson Creek Range to the south, and the Fortification Range to the southwest. Most of Spring Valley is in White Pine County except for the very southern portion located in Lincoln County. U.S. Highway 50 bisects the valley and U.S. Highway 93 runs along the valley's western flank. The predominant uses of water in the valley are for irrigation and stockwater.

There are reportedly 27 perennial streams and 503 springs in Spring Valley. Most water wells are shallow (less than 300 ft.) and about 1/3 are less than 100 ft. deep. Analyses show that the groundwater flows both from the north part of the valley to the central part, and from the south part of the valley to the central part. Salt-crusted playa lakebeds (with varying degrees of wetness) are common in the low areas of the valley.

The chemical composition of Spring Valley groundwater consists mainly of three basic compositions. These are (1) Calcium-Sodium-Bicarbonate-Chloride; (2) Calcium-Magnesium-Sodium-Bicarbonate; and (3) Calcium-Magnesium-Sodium-Bicarbonate-Sulfate. Arsenic is a common constituent in the valley, and reportedly exceeds the maximum allowable EPA limits in some springs and in places in the valley floor. Isotopic composition analyses of the springs, creeks, and wells in Spring and Snake Valleys implies the existence of a common recharge source for all of them.

Most of the playa lakes in Spring Valley are barren, commonly with a crust layer of salt. The depth to the water table in these areas may be shallow, and in some places these playas are wet to the surface and even ponded for much of the year. Phreatophytic vegetation (plants that receive supplemental moisture from shallow ground water) occurs in the valley, as do wetland and meadow areas.

Based upon a review of the NRCS soil survey for Spring Valley, it was determined that:

1. There are 41,402 acres that are ponded part or most of the year with shallow ground water. Much of these are in playas.

2. There are 26,359 acres that are not ponded, but have groundwater at depths of less than 6 feet for much of the year.

4.0 Overview of Effects of Proposed Project on Water Resource Conditions

Water is the most influential component of the ecosystem in this area. Soil conditions, plant conditions, and air quality are all directly or indirectly affected by soil and surface water. It is projected that groundwater levels will drop by about 10 feet in the aquifers that are pumped (BLM, 2011). If this is the case and groundwater levels drop by 10 feet, the ponded areas in many parts of the valley would no longer be ponded; the shallow groundwater regime under which the phreatopytic plant communities became established would be altered; wetland areas would likely become dry; and meadows would no longer have the water supply needed to maintain their existence. Water is the sustaining resource of all of these areas. Removal of the water from the soil root zones and alteration of the ponding features of the valley may have a dramatic effect on the environmental conditions of Spring Valley.

5.0 Overview of the Potential Impact of Proposed Project on Soil and Related Resources

There are two levels of evaluation that have been done by the BLM regarding the effects of the proposed action. The first level is the effects of site-specific construction and operation activities, such as pipelines and other facilities. The second level is the more regional evaluation of the effects of the drawdown of the ground water on soil, vegetation, and other resources across the project area. It is the more regional effects of withdrawal that is the primary focus of this assessment. Further, it is the focus of this assessment to consider the potential for wind erosion and associated dust generation in Spring Valley, and the potential effects on vegetation and air quality.

Table 1 lists all of the NRCS soil survey map units that are playas, ponded, or with high water tables and that were delineated in the survey. In the course of conducting the soil survey, the NRCS defined the water features associated with the various soils occurring in the Spring Valley area. These soil data appear to be the most detailed information available regarding the soil conditions in the area. According to these data, there are 41,402 acres within Spring Valley that are playas or ponded during some or most of the year in most years; and there are 26,359 acres with the water table within six feet of the soil surface, allowing plants to benefit from this source of moisture.

Playas

It is been demonstrated on Owens Lakebed in California that soil moisture is a primary binder of salt crusted areas and prevents the generation of dust. Shallow flooding (keeping the soil moist to the surface) is the most extensive dust mitigation measure used on Owens Lakebed. Although it has not been shown that the playa conditions in Spring Valley are comparable to Owens Lakebed, the lesson is clear: drying salt-encrusted playas can only increase dust generation. The soil conditions on Owens Lakebed have been thoroughly studied, and these studies were vital in arriving at the proper prescription to control the dust there. The soil conditions (including the thickness, chemical content, moisture content, etc. of the salt crusts) of the playas in Spring Valley have not been evaluated. The NRCS soil survey simply identifies these areas as "playas" with no further data or information presented. Consequently, data that are essential to evaluating the effects of de-watering of the playas are not available. When one considers that there are 41,402 acres of land that are in playas or ponded in Spring Valley, and that this acreage exceeds that of Owens Lakebed by almost a factor two, the potential risk of adverse impacts is great.

Wetlands and Ponded Areas

Wetland areas and meadows potentially are contributors to dust generation if the water is removed from the ecosystem. Virtually no dust is generated from wetland areas in their current natural state. Any action that results in a decrease of plant biomass in a desertic climate should be carefully evaluated as it can only serve to increase the potential for soil erosion and dust generation. If wetland areas are de-watered, it is very likely that they could become salinized. Salinization in areas such as these occurs in two ways. Firstly, the salts in the water of the wetlands will be left behind when the water evaporates. Secondly, as the water table beneath the wetlands and meadows begins to drop, soil moisture will "wick" to the top of the soil from the underlying water table; when the moisture reaches the soil surface it evaporates, leaving a concentration of salt on the soil surface. Over time, as conditions that are unfavorable to plant growth begin to develop, plant cover will diminish and wind erosion potential will increase. The NRCS Soil Survey supports this in a very graphic way. The productivity of a Wet Meadow ecological site is estimated to be 2,000 lbs. of forage per acre per year. If this site is converted to a Dry Saline Meadow Ecological Site, the forage production drops to 400 lbs. per year. In other words, the productivity of the site drops by 80% as a result of de-watering.

Riparian and Phreatophytic Areas

Riparian areas and areas of phreatophytes are important components to the ecosystem. Their biomass and physical presence acts as buffers to wind movement and protects soil from surface wind erosion. By dropping the water table, many of these areas may be in danger of being eliminated, and replaced with plant communities that are much less effective in preventing soil erosion. The degree of change that these ecosystems will incur is unknown, and it is not certain that sufficient site-specific data are available to make meaningful predictions regarding the environmental impact of the proposed action on these areas.

6.0 Kinds of Data Needed for Appropriate Analyses of the Effects of the Project

Playas

Very little data currently exists for the playa areas of Spring Valley. One of the most readily available sets of data on soil resources is the NRCS soil survey. This survey, however, did not provide any data regarding the properties of the playas as it simply identified them as "playas" (miscellaneous land type).

The nearest similar situation to that of Spring Valley that has occurred recently was at Owens Lakebed in California. Owens Lake was a large saline lake which was dewatered in the early 1900's to provide water to the Los Angeles area. The result was an exposed lakebed of more than 22,000 acres in size. Dust from the lakebed violated federal clean air standards, and the city of Los Angeles was charged with the cost of clean-up. Before cleanup could begin, it was necessary to conduct many studies on the lakebed to determine the best prescriptions for clean-up. One of those studies was an Order 2 Soil Survey, in which the physical and chemical properties of the salt crust and underlying soil were carefully characterized and delineated. Proper mitigation could not move forward without this type of knowledge of the site-specific soil and salt crust conditions.

The playa conditions in Spring Valley are likely to be different than those in Owens Lakebed. Nevertheless, the same type of resource information is needed in order to properly predict the effects of de-watering these areas and to describe mitigation alternatives so that the proposed action will not have disastrous results if implemented. This kind of information can be provided within reasonable time frames with methodologies that have been developed and used across the United States. At the present time, this information does not exist and it is with great uncertainties that this project proceeds forward without it.

Scientific literature notes that soil characteristics, surface condition, use and disturbance have a strong impact on dust and PM10 generation. Dust generation from playas is known to be affected by playa geomorphology and mineralogy, surface conditions, salt or other surface crusting, disturbance, and moisture status. Quick drying and soft crusts contribute to both dust and PM10 emissions. Methodologies for characterizing mineralogy of dust and their health impacts are well-established.

Wetlands and Ponded Areas (Hydric Soils)

Sufficient data may currently exist to evaluate the impact of the proposed action on these areas. However, that analysis has not been made. The BLM, in their Environmental Impact Statement dated June 2011, states that the response of wetlands to drawdown will vary widely across the area, yet they concluded that there would be no change to the susceptibility of these areas for wind erosion as a result of the drawdown and removal of the water.

An appropriate analysis of the impacts of drawdown on these areas can likely be made from the existing NRCS soil survey, coupled with proper techniques used to measure and predict wind erosion. As one example of the effects of local variability of soil conditions, consider the Kolder soil series mapped in the NRCS soil survey. This soil is a hydric soil, supporting wetland vegetation and contributing little if any dust due to wind erosion. This soil is saline throughout the root zone. With these types of soils, as water is removed through evaporation the salt becomes more concentrated through time and these soils become saline. Excessive soil salinity in the absence of moisture is detrimental to the establishment of dense ground cover; consequently, it is likely that bare, salt-crusted areas would occur in this soil as it is de-watered. Obviously, this soil has the potential to contribute significantly to dust through its susceptibility to wind erosion in the de-watered state.

It is reasonable to expect that these kinds of analyses be conducted. The data are generally available; the science is proven; and the methodology is well-known.

Riparian and Phreatophytic Areas

Comments regarding the analysis for Riparian and Phreatophytic Areas are very similar to those for Wetlands and Ponded areas, and will not be repeated here. It is uncertain as to whether sufficient data exists to evaluate these areas appropriately.

Table 1:
Spring Valley NRCS Map Units Identified as Playas, Ponded, or With High Water Table

White Pine Nevada, Eastern Part
NRCS soil survey area 779

Map Unit	Total Acres in MU	Name of MU Component	% of MU	Acres of Component	Wetness Category
1160	552	Kolda	2	11	2
1326	948	Kolda	4	38	1
1370	1,332	Kolda	5	67	1
1371	1,753	Kolda	5	88	1
3000	476	Playas	5	24	1
3004	15,638	Playas	15	2,346	1
3005	4,444	Playas	30	1,333	1
		Kolda	5	222	1
		Hogum	3	133	1
3008	4,947	Playas	20	989	1
3041	1,335	Kolda	2	27	1
3130	363	Playas	4	15	1
3132	2,123	Playas	6	127	1
3180	3,236	Playas	1	32	1
3189	2,018	Ewelac	25	505	1
		Biji	20	404	2
		Kolda	5	101	1
3191	6,853	Playas	6	411	1
3193	2,931	Biji	20	586	2
3195	1,100	Ewelac	50	550	2
		Biji	15	165	2
3196	12,868	Benin	40	5,147	1
		Playas	2	257	1
3197	1,578	Ewelac	15	237	1
3290	7,624	Kolda	1	76	1
3291	2,631	Kolda	2	53	1
3340	5,963	Playas	5	298	1
3341	2,877	Playas	6	173	1
3342	6,459	Playas	2	129	1
3343	16,763	Kolda	2	335	1

Acre Totals

Category 1: 41,402
Category 2: 26,359

Combined: 67,761

Category 1: Ponds/Playas
Category 2: WT <6.0'

Table 1 (Continued)

Map Unit	Total Acres In MU	Name of MU Component	% of MU	Acres of Component	Wetness Category
3344	6,877	Kolda	1	69	1
3443	3,423	Kolda	5	171	1
3500	5,983	Ewelac	40	2,393	2
		Biji	30	1,795	2
		Medlaval	15	898	2
		Kolda	6	299	1
3505	1,198	Ewelac	55	659	1
		Biji	30	359	2
		Kolda	2	24	1
3506	563	Biji	35	197	2
		Kolda	4	23	1
3507	7,622	Ewelac, occasionally flooded	35	2,668	1
		Ewelac	30	2,287	2
		Biji	20	1,524	2
		Kolda	6	457	1
3508	1,364	Ewelac	70	955	1
		Hogum	5	68	1
3509	4,103	Ewelac	50	2,052	1
3510	4,876	Biji	60	2,926	2
		Ewelac	30	1,463	1
		Kolda	4	195	1
3512	890	Kolda	1	9	1
3600	1,186	Biji	45	534	2
		Kolda	30	356	1
		Ewelac	15	178	1
3700	8,848	Kolda	55	4,866	1
		Duffer	30	2,654	2
3702	817	Kolda	45	368	1
		Biji	30	245	2
		Kolda	15	123	1

Table 1 (Continued)

Map Unit	Total Acres In MU	Name of MU Component	% of MU	Acres of Component	Wetness Category
3715	1,102	Ewelac	50	551	1
		Kolda	20	220	1
3770	1,294	Ewelac	35	453	1
		Biji	20	259	2
		Kolda	4	52	1
4050	15,555	Playas	5	778	1
4051	3,571	Playas	5	179	1
4052	16,726	Kolda	5	836	1
		Playas	5	836	1
4060	5,650	Ocala	45	2,543	1
		Duffer	25	1,413	2
		Kolda	15	848	1
4112	1,783	Playas	5	89	1
4121	10,525	Biji	15	1,579	2
5000	7,034	Playas	100	7,034	1
5010	6,325	Biji	30	1,898	2
		Hogum	3	190	1
5030	2,715	Biji	30	815	2
		Duffer	30	815	2
		Hogum	25	679	1

7.0 Signatures

Clifford R Landers ______ 6/20/11

Cliff Landers Date

Clay Robinson ______ 6-30-11

Clay Robinson Date

Attachments: Curriculum Vitae

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